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**APPLICATION  
FOR  
UNITED STATES  
LETTERS PATENT**

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**FOR:                      TABLETOP-TYPE AIR CLEANER**

**DOCKET NO.:        OD02062US**

## TABLETOP-TYPE AIR CLEANER

### BACKGROUND OF THE INVENTION

#### 5 Field of the Invention

The present invention relates to a personal tabletop-type air cleaner to remove smoke of a cigarette, that can be placed on a desk, table, or a like.

10 The present application claims priority of Japanese Patent Application No. 2002-230668 filed on August 7, 2002, which is hereby incorporated by reference.

#### Description of the Related Art

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Conventionally, in an air cleaner of this type, as shown in Fig. 10, a suction port 1 of smoke is placed at a front 1A of the air cleaner and a blow-off port 2 of cleaned air is placed at a rear 2A of the air cleaner. It has configurations of an air flow passage which, figuratively speaking, are reverse to those of a fan. However, the conventional air cleaner has a problem. That is, when such the conventional air cleaner is put at a place being near to a wall or fittings at the rear 2A of the air cleaner, since its blow-off port 2 placed at the rear 2A of the air cleaner  
20 is blocked, very poor usability is provided.

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To solve such the problem as above, an air cleaner is disclosed, for example, in Japanese Patent No. 3092112 which has been obtained by the applicant of the present invention. In the air cleaner disclosed in this patent, as shown in Fig. 11, only

at a front 3A of the air cleaner is placed an opening portion 3 and on an inside of the opening portion 3 are placed an intra-device suction port  $3_i$  to suck cigarette smoke and a plurality of intra-device blow-off ports  $3_o$ ,  $3_o$ , ... to blow off cleaned air. More particularly, the intra-device suction port  $3_i$  is placed directly on an inside of the opening portion 3 in a manner that a central axis of the intra-device suction port  $3_i$  approximately conforms to that of the opening portion 3. On the other hand, the intra-device blow-off ports  $3_o$ ,  $3_o$ , ... are placed discretely at four places in a manner that a normal to a blow-off surface of each of the intra-device blow-off ports  $3_o$ ,  $3_o$ , ... is approximately orthogonal to a normal to an opening surface of the opening portion 3 at its four corners being positioned directly on an inside of a fringe of the opening portion 3. By configuring as above, since a vortex flow of cleaned air is blown from the intra-device blow-off ports  $3_o$ ,  $3_o$ , ... around cigarette smoke that is being sucked into the intra-device suction port  $3_i$ , dispersion of the cigarette smoke is suppressed and, as a result, improvement in smoke sucking efficiency is expected.

However, has turned out that complete formation of a vortex flow is, in actual fact, not easy and its cost is high. In other words, it is not easy to obtain such a stable vortex flow as desired by employing an air cleaner having a simple configuration, there is potentially a fear that an air flow that would impair suction of cigarette smoke occurs. A descending flow being produced by crumbling of the vortex flow and impinging on a desk, in particular, presents a problem since it causes documents on tables to wiggle and it is offensive to users.

SUMMARY OF THE INVENTION

In view of the above, it is an object of the present invention to provide a personal tabletop-type air cleaner which is user friendly and improves smoke sucking efficiency in a simple configuration.

According to a first aspect of the present invention, there is provided a tabletop-type air cleaner including:

a front opening portion to suck air containing smoke of a cigarette, the front opening portion being placed at a front of the air cleaner;

a blower to forcedly feed the air having been sucked from the front opening portion in a centrifugal direction;

a pair of right and left peripheral opening portions to emit air fed forcedly from the blower ahead of the air cleaner, the pair of peripheral opening portions being placed in a fringe portion on the right and the left at the front of the air cleaner; and

a porous or fibrous dust collecting filter being placed between the front opening portion and the blower and/or between the blower and each of the peripheral opening portions making up the pair of right and left peripheral opening portions to remove the smoke of the cigarette.

In the foregoing, a preferable mode is one wherein deodorizing filters each being placed between the front opening portion and the blower and/or between the blower and each of the peripheral opening portions making up the pair of right and left peripheral opening portions are mounted.

A preferable mode is one wherein the blower is a

centrifugal- type blower having a blade wheel in which a plurality of blades is arranged in a ring-like form and being mounted in a manner that a central axis of the blade wheel approximately conforms to a central axis of the front opening portion, in which  
5 the blower, while being operated, captures air from a direction of the central axis of the blade wheel, provides the captured air with turn-around flows, and forcedly feeds, by using generated centrifugal force, air that turns around, from clearances among the blades toward a direction of a portion surrounding the blade  
10 wheel.

Also, a preferable mode is one wherein, between the front opening portion and the blower is placed a panel-shaped dust collecting filter which is operated in a form of a panel being folded up in a corrugated form.

15 Also, a preferable mode is one wherein a ring-shaped dust collecting filter is placed between the blower and each of the peripheral opening portions making up the pair of right and left peripheral opening portions and on a side of the portions surrounding the blade wheel in such a manner that a central axis  
20 of the dust collecting filter conforms to the central axis of the blade wheel.

Also, a preferable mode is one wherein a ring-shaped deodorizing filter is placed between the blower and each of the peripheral opening portions making up the pair of right and left  
25 peripheral opening portions and on the side of the portions surrounding the blade wheel in a manner that a central axis of the deodorizing filter conforms to the central axis of the blade wheel.

Also, a preferable mode is one wherein the air fed forcedly

from the blower is emitted toward an obliquely-forward direction of the air cleaner from the pair of right and left peripheral opening portions in a manner that the air is separated right and left.

5       Also, a preferable mode is one wherein each of the peripheral opening portions making up the pair of right and left peripheral opening portions is placed at a corner between a front and a side of the air cleaner.

10       Also, a preferable mode is one wherein each of the peripheral opening portions is formed so as to be approximately longitudinally long along a fringe of a front of the air cleaner.

Also, a preferable mode is one wherein the pair of right and left peripheral opening portions is arranged 25 cm or more and within 40 cm apart from each other in a horizontal direction.

15       Also, a preferable mode is one wherein each of the peripheral opening portions has a plurality of partitioning plates or blade plates which give a directional property to the air being emitted.

20       Also, a preferable mode is one wherein the partitioning walls or the blade plates are attached so as to be rotatable so that a direction of the air being emitted is changed.

Also, a preferable mode is one wherein an air-flow direction control circuit is mounted which is used to electrically control rotation of the partitioning plates or the wheel plates.

25       Also, a preferable mode is one wherein an electrically-controlled dust collecting unit is mounted which is used to electrostatically collect dust by corona charging fine particles floating in the air.

With the above configurations, since an air curtain

containing emitted air flows is formed on both sides of flows of cigarette smoke, cigarette smoke is retracted into the air cleaner without excessive dispersion of the cigarette smoke into surroundings. As a result, smoke sucking efficiency can be improved in a manner to be friendly to a human and in simple configuration.

#### BRIEF DESCRIPTION OF THE DRAWINGS

10       The above and other objects, advantages, and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view schematically illustrating an appearance of configurations of a personal use tabletop-type air cleaner according to a first embodiment of the present invention;

Fig. 2 is a front view schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1;

20       Fig. 3 is a top view schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1;

Fig. 4 is a side view schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1;

Fig. 5 is an exploded perspective view illustrating configurations of the personal use tabletop-type air cleaner of Fig. 1;

Fig. 6 is a cross-sectional view schematically illustrating

an internal configuration of the personal use tabletop-type air cleaner of Fig. 1;

Fig. 7 is a diagram explaining operations of the personal use tabletop-type air cleaner of Fig. 1;

5 Fig. 8 is a perspective view schematically illustrating an appearance of configurations of a personal use tabletop-type air cleaner according to a second embodiment of the present invention;

Fig. 9 is a perspective view schematically illustrating an appearance of configurations of a personal use tabletop-type air  
10 cleaner according to a third embodiment of the present invention;

Fig. 10 is a side view schematically illustrating configurations of a conventional air cleaner; and

Fig. 11 is a perspective view schematically illustrating configurations of another conventional air cleaner;

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#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Best modes of carrying out the present invention will be described in further detail using various embodiments with  
20 reference to the accompanying drawings.

#### First Embodiment

Figure 1 is a perspective view schematically illustrating  
25 an appearance of configurations of a personal use tabletop-type air cleaner according to a first embodiment of the present invention. Figure 2 is a front view schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1. Figure 3 is a top view

schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1. Figure 4 is a side view schematically illustrating the appearance of configurations of the personal use tabletop-type air cleaner of Fig. 1. Figure 5 is an exploded perspective view illustrating configurations of the personal use tabletop-type air cleaner of Fig. 1. Figure 6 is a cross-sectional view schematically illustrating an internal configuration of the personal use tabletop-type air cleaner of Fig. 1. Figure 7 is a diagram explaining operations of the personal use tabletop-type air cleaner of Fig. 1.

First, an entire configuration of the tabletop-type air cleaner is described. The tabletop-type air cleaner 4, as shown in Fig. 1 to Fig. 6, has a front opening portion 5 being placed at a front of the air cleaner 4 and operating to suck air containing cigarette smoke, a blower 6 to forcibly feed air having been sucked (inhaled) from the front opening portion 5 in a centrifugal direction, a pair of peripheral opening portions 7 each being placed on the right and the left in a fringe portion of the air cleaner 4 to blow off air that was fed forcibly from the blower 6, a dust collecting filter 8 being placed between the front opening portion 5 and the blower 6, a deodorizing filter 9 to remove cigarette smoke, the deodorizing filter 9 being sandwiched between the blower 6 and each of peripheral opening portions 7, and an operation panel portion 10 to perform an ON/OFF operation of the power source and to adjust an amount of an air flow.

Next, each of components of the air cleaner 4 is described. The front opening portion 5 is formed to be stripe-shaped and to be circular as a whole within a front panel 5a having an

approximately circular shape. Moreover, the blower 6 is a turbo blower made up of a blade wheel 6b having a plurality of blades 6a, 6a, ... being arranged in a ring-like form and a motor 6c to drive the blade wheel 6b and being mounted on an approximately  
5 circular main body 60 in a manner that a central axis of the blade wheel 6b and the motor 6c approximately conforms to that of the front opening portion 5. An approximately circular device box body is made up of the main body 60 and the front panel 5a.

Moreover, in a ring-like portion serving as a corner portion  
10 between a front and a side of the air cleaner 4 is placed a front peripheral portion cover 7a and in right and left portions of the front peripheral portion cover 7a is formed the above-described peripheral opening portions 7 each being approximately longitudinally long so that an air curtain can be formed by blowing  
15 air outside from each of the peripheral opening portions 7 in right and left portions of the front peripheral portion cover 7a. Additionally, in the embodiment, the air cleaner 4 is so constructed that the pair of the peripheral opening portions 7 each being placed on the right and the left blows off air fed  
20 forcedly from the blower 6 toward an obliquely forward side in a manner that the air is separated right and left therein. Moreover, in each of the right and left peripheral opening portions 7, a plurality of blade plates (partitioning plates) 7b, 7b, ... used to control a directional property of a flow of air being blown  
25 off is arranged at a specified distance in a horizontal grid form. Here, the right and left peripheral opening portions 7 are arranged 25 cm or more and within 40 cm apart from each other in a horizontal direction. This distance is determined by taking into consideration a horizontal width of a body of an adult human.

Moreover, the dust collecting filter 8 described above is so configured that a panel-like portion is formed which is constructed by folding up a sheet member, made of a porous or fibrous material that can catch and separate cigarette smoke, in a corrugated form and is held by a dust collecting filter holder 8h. The dust collecting filter 8 of the embodiment, when its life for dust collection is over, can be replaced. The deodorizing filter 9 is so configured as to be a ring-like body having a double structure made up of fine powdery activated carbon and granular activated carbon and to be placed on a side of outer portions surrounding the blade wheel 6b in a manner that a central axis of the deodorizing filter 9 conforms to a central axis of the blade wheel 6b and that the deodorizing filter 9 is held by a deodorizing filter holder 9h. The deodorizing filter holder 9h is formed integrally with the front peripheral portion cover 7a and at its front is placed a plurality of concave portions (not shown) used to hold the dust filter holder 8h for positioning. The deodorizing filter holder 9h and the front peripheral portion cover 7a, both having been formed integrally, are so constructed as to be attached to the main body 60 which provides an appearance of a rear side of the tabletop-type air cleaner 4 in a manner to be detachable/ attachable. The deodorizing filter holder 9h, when its life as a deodorizer is over, can be also replaced.

Next, operations of the tabletop-type air cleaner 4 having configurations described above are explained by referring to Fig. 7. While a user takes a smoke, when a switch of the tabletop-type air cleaner 4 is turned ON, operations of the blower 6 are started. While the blower 6 is in an operated state, when smoke is emitted aiming at a front of the tabletop-type air cleaner 4

(placed 30 cm to 60 cm before the smoker), air DA containing cigarette smoke is sucked from the front opening portion 5. Then, the sucked air DA passes through the dust collecting filter 8 and, at this point, cigarette smoke is caught and removed by the dust collecting filter 8. Therefore, air having passed through the dust collecting filter 8 and having reached inner portions surrounding the blade wheel 6b is clean air MA from which cigarette smoke has been removed. However, odor molecules of a cigarette cannot be completely removed and some odor molecules of the cigarette odor still remain therein.

Next, the air MA turns around by being pressed by each of the blades 6a of the blade wheel 6b and is fed forcedly by centrifugal force occurred then through clearances among the blades 6a toward a direction of a fringe of the blade wheel 6b. On a side of a portion surrounding the blade wheel 6b, the deodorizing filter 9 is placed that surrounds the blade wheel 6b concentrically. Therefore, the air MA being fed forcedly toward the direction of the fringe of the blade wheel 6b passes through the deodorizing filter 9 and, at the time of the passage, residual odor molecules having turn-around flows is adsorbed and removed by the deodorizing filter 9. Air CA having been further cleaned by the deodorizing filter 9, as shown in Fig. 7, is emitted from the right and left peripheral opening portions 7 toward a direction of a front of the air cleaner 4 (in the embodiment, to obliquely-forward directions S, S of the air cleaner 4 in a manner that the air is separated right and left). In the embodiment, since a distance between a smoker and the tabletop-type air cleaner 4 is set within a range of 30 cm to 60 cm and since a distance between the right and left peripheral opening portions 7 is set to be 25

cm to 40 cm, the air CA being emitted from the peripheral opening portions 7 toward to an obliquely-forward directions S of the air cleaner 4 may strike on both shoulders or both arms (upper arm) of the smoker or may pass through portions directly outside both  
5 the shoulders or both the arms.

In the above configuration, the air flows of cleaned air CA being emitted from the tabletop-type air cleaner 4 occur on both right and left sides of the air flow (air containing smoke of cigarette) DA being sucked into the tabletop-type air cleaner  
10 4. Here, a flowing speed of the air flow DA being sucked into the air cleaner 4 is high in a central region of the flow and becomes the lower in a peripheral position of the flow, that is, in the region being the nearer to the emitted air flow of cleaned air CA that reverses a direction of the air flow DA. According to a  
15 law of hydrodynamics, smoke particles flowing through the peripheral region of the flow (low-speed flowing region) go toward the central region of the flow (high-speed flowing region) and therefore it is not easy for cigarette smoke to enter the emitted air flow of cleaned air CA. This phenomenon causes the emitted  
20 air flow of cleaned air CA to serve as an air curtain to intercept cigarette smoke and to push the cigarette smoke back to the central position. As a result, cigarette smoke is retracted, without excessive dispersion into surroundings, into the tabletop-type air cleaner 4 through the front opening portion 5. Thus, a personal  
25 use tabletop-type air cleaner 4 can be achieved which can be friendly to a human and can improve smoke sucking efficiency in a simple configuration.

### Second Embodiment

Figure 8 is a perspective view schematically illustrating an appearance of configurations of a personal use tabletop-type air cleaner 40 according to a second embodiment of the present invention. Unlike in the case of the first embodiment in which a plurality of blade plates (partitioning plate) 7b are arranged in a horizontal grid form in peripheral opening portions 7 to control a direction of an air flow being emitted, in the second embodiment, as shown in Fig. 8, a plurality of the blade plates (partitioning plates) 71b are arranged in a vertical grid form in the peripheral opening portions 71. By configuring as above, same effects obtained as in the first embodiment can be also obtained. Other parts of the air cleaner 40 are the same as those in the first embodiment, therefore description of them has been omitted.

### Third Embodiment

Figure 9 is a perspective view schematically illustrating an appearance of configurations of a personal use tabletop-type air cleaner 400 according to a third embodiment of the present invention. Unlike in the case of the second embodiment in which blade plates (partitioning plates) 71b are of a fixed-type plate type, in the third embodiment, as shown in Fig. 9, a plurality of blade plates (partitioning plates) 72b is placed in a manner so as to be rotatable in peripheral opening portions 72 and an air-flow direction control circuit 73 is mounted which is used to electrically control rotation of the blade plates

(partitioning plates) 72b.

Thus, in the configurations of the third embodiment, since a direction of flowing of an emitted air CA can be changed according to a user's preference, further comfort feeling can be obtained.

5        Other parts of the air cleaner 400 with same reference numbers are basically the same as those of the first embodiment are the same as those in the first embodiment, and therefore their description of them has been omitted.

It is apparent that the present invention is not limited  
10 to the above embodiments but may be changed and modified without departing from the scope and spirit of the invention. For example, in the above embodiments, the dust collecting filter and the deodorizing filter that make a pair are mounted together, however, whenever necessary, only the dust collecting filter may be mounted  
15 or only the deodorizing filter may be mounted. Also, in the above embodiments, the dust collecting filter is placed between the front opening portion and the blower, however, the dust collecting filter may be placed between the blower and the peripheral opening portion. Similarly, the deodorizing filter may be mounted between  
20 the front opening portion and the blower.

Moreover, a human body sensor to detect a human causing operations of the air cleaner to be started or a smoke detecting sensor to detect smoke causing its operations to be started may be incorporated in the operation panel of the air cleaner of the  
25 present invention. Also, in the above embodiment, the peripheral opening portion is placed at a corner between the front and side of the air cleaner, however, the peripheral opening portion may be mounted only in portions surrounding the front of the air cleaner. Furthermore, in order to ensure dust collecting

efficiency, an electrically-controlled dust collecting unit is mounted which can electrostatically collect dust by corona charging fine particles floating in air.